

What is claimed is:

1 1. An apparatus for measuring a voltage fluctuation
2 waveform of a power source system of a functional circuit
3 operated on a first rated voltage in a semiconductor integrated
4 circuit, comprising:

5 a power-source-system waveform converting circuit,
6 disposed close to the functional circuit and in the
7 semiconductor integrated circuit and operated on a second
8 rated voltage higher than the first rated voltage, for
9 converting said voltage fluctuation waveform of the power
10 source system into an electrical current waveform;

11 a power-source-system fluctuation waveform output
12 terminal for outputting said electric current waveform
13 obtained by said power-source-system waveform converting
14 circuit outside the semiconductor integrated circuit; and

15 a power-source-system fluctuation waveform output
16 wiring, arranged in the semiconductor integrated circuit,
17 for connecting said power-source-system waveform converting
18 circuit and said power-source-system fluctuation waveform
19 output terminal.

1 2. An apparatus according to claim 1, wherein, when
2 a grounded system of said power-source-system waveform
3 converting circuit is disconnected from a grounded system
4 of the functional circuit, said power-source-system waveform
5 converting circuit converts a potential fluctuation waveform

6 relative to a ground level of an external voltage source
7 connected to the power source system of the functional circuit,
8 which potential fluctuation waveform is in the form of said
9 voltage fluctuation waveform of the power source system, into
10 said electric current waveform.

1 3. An apparatus according to claim 1, wherein a
2 grounded system for an I/O circuit of the semiconductor
3 integrated circuit is used as a grounded system of said
4 power-source-system waveform converting circuit.

1 4. An apparatus according to claim 1, wherein, when
2 a grounded system of said power-source-system waveform
3 converting circuit is connected to a grounded system of the
4 functional circuit, said power-source-system waveform
5 converting circuit converts a potential fluctuation waveform
6 of a potential between the power source system and the grounded
7 system of the functional circuit, which potential fluctuation
8 waveform is in the form of said voltage fluctuation waveform
9 of the power source system, into said electric current
10 waveform.

1 5. An apparatus according to claim 1, wherein:
2 said power-source-system waveform converting circuit
3 is an n-channel MOSFET (metal-oxide-semiconductor field
4 effect transistor);
5 the gate terminal of the n-channel MOSFET is connected

6 to the power source system of the functional circuit;
7 the source terminal of the n-channel MOSFET is
8 connected to a grounded system of said power-source-system
9 waveform converting circuit; and
10 the drain terminal of the n-channel MOSFET is connected
11 to said power-source-system fluctuation waveform output
12 terminal through said power-source-system fluctuation
13 waveform output wiring.

1 6. An apparatus according to claim 1, wherein said
2 power-source-system fluctuation waveform output terminal is
3 connected to a power source system which supplies the second
4 rated voltage and which is disposed outside the semiconductor
5 integrated circuit.

1 7. An apparatus according to claim 6, wherein a first
2 resistor having a first predetermined resistance is
3 interposed between said power-source-system fluctuation
4 waveform output terminal and the power source system that
5 supplies the second rated voltage.

1 8. An apparatus for measuring a voltage fluctuation
2 waveform of a grounded system of a functional circuit operated
3 on a first rated voltage in a semiconductor integrated circuit,
4 comprising:

5 a grounded-system waveform converting circuit,
6 disposed close to the functional circuit and in the

7 semiconductor integrated circuit and operated on a third rated
8 voltage higher than the first rated voltage, for converting
9 said voltage fluctuation waveform of the grounded system into
10 an electrical current waveform;

11 a grounded-system fluctuation waveform output
12 terminal for outputting said electric current waveform
13 obtained by said grounded-system fluctuation waveform
14 converting circuit outside the semiconductor integrated
15 circuit; and

16 a grounded-system fluctuation waveform output wiring,
17 arranged in the semiconductor integrated circuit, for
18 connecting said grounded-system waveform converting circuit
19 and said grounded-system fluctuation waveform output
20 terminal.

1 9. An apparatus according to claim 8, wherein said
2 grounded-system waveform converting circuit is connected to
3 a power source system different from the power source system
4 of the functional circuit.

1 10. An apparatus according to claim 9, wherein a power
2 source system for an I/O circuit of the semiconductor
3 integrated circuit is used as the power source system that
4 is connected to said grounded-system waveform converting
5 circuit.

1 11. An apparatus according to claim 8, wherein, when

2 a power source system of said grounded-system waveform
3 converting circuit is connected to a power source system of
4 the functional circuit, said grounded-system waveform
5 converting circuit converts a potential fluctuation waveform
6 of a potential between the power source system and the grounded
7 system of the functional circuit, which potential fluctuation
8 waveform is in the form of said voltage fluctuation waveform
9 of the grounded system, into said electric current waveform.

1 12. An apparatus according to claim 8, wherein:

2 said grounded-system waveform converting circuit is
3 a p-channel MOSFET (metal-oxide-semiconductor field effect
4 transistor);

5 the gate terminal of the p-channel MOSFET is connected
6 to the grounded system of the functional circuit;

7 the drain terminal of the p-channel MOSFET is connected
8 to a power source system of said grounded-system waveform
9 converting circuit; and

10 the source terminal of the p-channel MOSFET is
11 connected to said grounded-system fluctuation waveform output
12 terminal through said grounded-system fluctuation waveform
13 output wiring.

1 13. An apparatus according to claim 8, wherein said
2 grounded-system fluctuation waveform output terminal is
3 connected to a power source system which supplies the third
4 rated voltage and which is disposed outside the semiconductor

5 integrated circuit.

1 14. An apparatus according to claim 13, wherein a
2 second resistor having a second predetermined resistance is
3 interposed between said grounded-system fluctuation waveform
4 output terminal and the power source system that supplies
5 the third rated voltage.

1 15. An apparatus for measuring a voltage fluctuation
2 waveform of a power source system of a functional circuit
3 operated on a first rated voltage in a semiconductor integrated
4 circuit and a voltage fluctuation waveform of a grounded system
5 of the functional circuit, comprising:

6 a power-source-system waveform converting circuit,
7 disposed close to the functional circuit and in the
8 semiconductor integrated circuit and operated on a second
9 rated voltage higher than the first rated voltage, for
10 converting said voltage fluctuation waveform of the power
11 source system into an electrical current waveform;

12 a grounded-system waveform converting circuit,
13 disposed close to the functional circuit and in the
14 semiconductor integrated circuit and operated on a third rated
15 voltage higher than the first rated voltage, for converting
16 said voltage fluctuation waveform of the grounded system into
17 an electrical current waveform;

18 a power-source-system fluctuation waveform output
19 terminal for outputting said first electric current waveform

20 obtained by said power-source-system waveform converting
21 circuit outside the semiconductor integrated circuit;
22 a grounded-system fluctuation waveform output
23 terminal for outputting said second electric current waveform
24 obtained by said grounded-system fluctuation waveform
25 converting circuit outside the semiconductor integrated
26 circuit;
27 a power-source-system fluctuation waveform output
28 wiring, arranged in the semiconductor integrated circuit,
29 for connecting said power-source-system waveform converting
30 circuit and said power-source-system fluctuation waveform
31 output terminal; and
32 a grounded-system fluctuation waveform output wiring,
33 arranged in the semiconductor integrated circuit, for
34 connecting said grounded-system waveform converting circuit
35 and said grounded-system fluctuation waveform output
36 terminal.

1 16. An apparatus according to claim 15, wherein, when
2 a grounded system of said power-source-system waveform
3 converting circuit is disconnected from the grounded system
4 of the functional circuit, said power-source-system waveform
5 converting circuit converts a potential fluctuation waveform
6 relative to a ground level of an external voltage source
7 connected to the power source system of the functional circuit,
8 which potential fluctuation waveform is in the form of said
9 voltage fluctuation waveform of the power source system, into

10 said electric current waveform.

1 17. An apparatus according to claim 15, wherein said
2 grounded-system waveform converting circuit is connected to
3 a power source system different from the power source system
4 of the functional circuit.

1 18. An apparatus according to claim 16, wherein said
2 grounded-system waveform converting circuit is connected to
3 a power source system different from the power source system
4 of the functional circuit.

1 19. An apparatus according to claim 17, wherein a
2 power source system for an I/O circuit of the semiconductor
3 integrated circuit is used as the power source system that
4 is connected to said grounded-system waveform converting
5 circuit.

1 20. An apparatus according to claim 18, wherein a
2 power source system for an I/O circuit of the semiconductor
3 integrated circuit is used as the power source system that
4 is connected to said grounded-system waveform converting
5 circuit.

1 21. An apparatus according to claim 15, wherein:
2 said power-source-system waveform converting circuit
3 is an n-channel MOSFET (metal-oxide-semiconductor field

4 effect transistor);
5 the gate terminal of the n-channel MOSFET is connected
6 to the power source system of the functional circuit;
7 the source terminal of the n-channel MOSFET is
8 connected to a grounded system of said power-source-system
9 waveform converting circuit;
10 the drain terminal of the n-channel MOSFET is connected
11 to said power-source-system fluctuation waveform output
12 terminal through said power-source-system fluctuation
13 waveform output wiring;
14 said grounded-system waveform converting circuit is
15 a p-channel MOSFET;
16 the gate terminal of the p-channel MOSFET is connected
17 to the grounded system of the functional circuit;
18 the drain terminal of the p-channel MOSFET is connected
19 to the power source system of said grounded-system waveform
20 converting circuit; and
21 the source terminal of the p-channel MOSFET is
22 connected to said grounded-system fluctuation waveform output
23 terminal through said grounded-system fluctuation waveform
24 output wiring.

1 22. An apparatus according to claim 15, wherein:
2 said power-source-system fluctuation waveform output
3 terminal is connected to a power source system which supplies
4 the second rated voltage and which is disposed outside the
5 semiconductor integrated circuit; and

6 said grounded-system fluctuation waveform output
7 terminal is connected to a power source system which supplies
8 the third rated voltage and which is disposed outside the
9 semiconductor integrated circuit.

1 23. An apparatus according to claim 22, wherein:
2 a first resistor having a first predetermined
3 resistance is interposed between said power-source-system
4 fluctuation waveform output terminal and the power source
5 system that supplies the second rated voltage; and
6 a second resistor having a second predetermined
7 resistance is interposed between said grounded-system
8 fluctuation waveform output terminal and the power source
9 system that supplies the second rated voltage.

1 24. A semiconductor integrated circuit including a
2 functional circuit, being operated on a first rated voltage,
3 and having a function for measuring a voltage fluctuation
4 waveform of a power source system of the functional circuit,
5 comprising:
6 a power-source-system waveform converting circuit,
7 disposed close to the functional circuit and in said
8 semiconductor integrated circuit and operated on a second
9 rated voltage higher than the first rated voltage, for
10 converting said voltage fluctuation waveform of the power
11 source system into an electrical current waveform;
12 a power-source-system fluctuation waveform output

13 terminal for outputting said electric current waveform
14 obtained by said power-source-system waveform converting
15 circuit outside said semiconductor integrated circuit; and
16 a power-source-system fluctuation waveform output
17 wiring for connecting said power-source-system waveform
18 converting circuit and said power-source-system fluctuation
19 waveform output terminal.

1 25. A semiconductor integrated circuit including a
2 functional circuit, being operated on a first rated voltage,
3 and having a function for measuring a voltage fluctuation
4 waveform of a grounded system of the functional circuit,
5 comprising:

6 a grounded-system waveform converting circuit,
7 disposed close to the functional circuit and in said
8 semiconductor integrated circuit and operated on a third rated
9 voltage higher than the first rated voltage, for converting
10 said voltage fluctuation waveform of the grounded system into
11 an electrical current waveform;

12 a grounded-system fluctuation waveform output
13 terminal for outputting said electric current waveform
14 obtained by said grounded-system fluctuation waveform
15 converting circuit outside said semiconductor integrated
16 circuit; and

17 a grounded-system fluctuation waveform output wiring
18 for connecting said grounded-system waveform converting
19 circuit and said grounded-system fluctuation waveform output

20 terminal.

1 26. A semiconductor integrated circuit including a
2 functional circuit, being operated on a first rated voltage,
3 and having a function for measuring a voltage fluctuation
4 waveform of a power source system of the functional circuit
5 and a voltage fluctuation waveform of a grounded system of
6 the functional circuit, comprising:

7 a power-source-system waveform converting circuit,
8 disposed close to the functional circuit and in said
9 semiconductor integrated circuit and operated on a second
10 rated voltage higher than the first rated voltage, for
11 converting said first voltage fluctuation waveform of the
12 power source system into an electrical current waveform;

13 a grounded-system waveform converting circuit,
14 disposed close to the functional circuit and in said
15 semiconductor integrated circuit and operated on a third rated
16 voltage higher than the first rated voltage, for converting
17 said second voltage fluctuation waveform of the grounded
18 system into an electrical current waveform;

19 a power-source-system fluctuation waveform output
20 terminal for outputting said first electric current waveform
21 obtained by said power-source-system waveform converting
22 circuit outside said semiconductor integrated circuit;

23 a grounded-system fluctuation waveform output
24 terminal for outputting said second electric current waveform
25 obtained by said grounded-system fluctuation waveform

26 converting circuit outside said semiconductor integrated
27 circuit;
28 a power-source-system fluctuation waveform output
29 wiring for connecting said power-source-system waveform
30 converting circuit and said power-source-system fluctuation
31 waveform output terminal; and
32 a grounded-system fluctuation waveform output wiring
33 for connecting said grounded-system waveform converting
34 circuit and said grounded-system fluctuation waveform output
35 terminal.